DOCUMENT RESUME

ED 126 000 SP 010 139

AUTHOR Thomas, Jerry R.
TITLE Effects of Perceptual-Motor Programs on Children.
PUB DATE Mar 76
NOTE 19p.; Paper presented at American Alliance for Health, Physical Education, and Recreation Southern District Annual Convention (Mobile, Alabama, March 18-21, 1976)

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS Academic Achievement; Cognitive Ability; Correlation; *Elementary School Students; Intellectual Development; Motor Development; *Perceptual Motor Learning; *Physical Education; Program Development; *Research Reviews (Publications); *Teacher Role; Theories

ABSTRACT

Practical implications for physical education teachers are drawn after a review of research on perceptual motor training programs for elementary school children. Three categories of theorists are identified: those who emphasize the intellectual involvement of the child in motoric functioning; those who stress development of perceptual motor bases underlying academic achievement; and those who focus on the neurological underpinnings of perceptual motor abilities. Research on the correlation between learning difficulties and motoric dysfunctions is discussed in relation to the types and validity of measuring instruments and the characteristics of subjects. The author examines variables affecting the findings of experimental programs, including theories, characteristics of subjects, objectives, length and intensity of training, degree of individualization, and incubation effects. Data lead the author to conclude that perceptual motor activities should not replace usual components of physical education programs unless the activities foster traditional objectives of physical fitness and skill development. (GW)

****
* Documents acquired by ERIC include many informal unpublished *
* materials not available from other sources. ERIC makes every effort *
* to obtain the best copy available. Nevertheless, items of marginal *
* reproducibility are often encountered and this affects the quality *
* of the microfiche and hardcopy reproductions ERIC makes available *
* via the ERIC Document Reproduction Service (EDRS). EDRS is not *
* responsible for the quality of the original document. Reproductions *
* supplied by EDRS are the best that can be made from the original. *
****

ED126000

EFFECTS OF PERCEPTUAL-MOTOR PROGRAMS ON CHILDREN

Jerry R. Thomas
Florida State University

U.S. DEPARTMENT OF HEALTH, EDUCATION & WELFARE
NATIONAL INSTITUTE OF EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

INTRODUCTION

It is extremely difficult to begin a discussion of P-M programs without first delimiting the word P-M to some extent. Seefeldt (1974) offers a comprehensive definition of the word P-M which includes the four processes of:

(1) discrimination and selection of a stimulus,
(2) integration of the stimulus with past experiences,
(3) purposeful movement in reply to a stimulus, and
(4) monitoring of the response (p. 266).

You may observe that this definition could easily include several of the theories of motor learning as well. However, most P-M programs are associated with academic performance outcomes and this unique aspect has tended to set P-M programs apart from the traditional physical education experience.

The purpose of this paper is to review the research in the perceptual-motor area (within the previously mentioned unique connotation) with the ultimate aim being to make some suggestions to the practitioner concerning the types of P-M programs that are likely to be successful in attaining certain specific objectives with specific types of children.

Cratty (1972) and Seefeldt (1974) present a very useful and informative historical summary of perceptual-motor theories underlying special training programs which have been in use for several years throughout the world. Cratty (1972) summarizes these theories into three categories. The first category is called "Theories Emphasizing Intellectual Abilities" (P. 42) and places the emphasis upon the intellectual involvement of the child as he functions motorically. Theorists falling in this group include Cratty (1969), Frostig (1970), Humphrey (1970, Kiphart (1968), and Mosstan (1966).

SP010 139

Special attention should be directed toward the change in Frostig's approach from her earlier work (Frostig & Horne, 1964). Frostig's early work dealt with the Frostig Developmental Test of Visual Perception (Maslow et al., 1964) and the training manual (Frostig & Horne, 1964) for difficulties diagnosed by this test. The training program was directed toward remediating the visual perceptual difficulties which Frostig claims underlie academic difficulties. However, in fairness to Frostig it should be pointed out that she clearly indicates that the training program should only be used for children below a minimum level of proficiency in visual-perceptual functioning. Many of the studies using the Frostig program did not follow her suggestions concerning the type children for which the program was designed and this may have resulted in many of the equivocal findings.

In recent years the direction of Frostig's work has moved toward that of Cratty and Humphrey. These three authors appear to be in agreement that in order to obtain significant academic performance benefits from movement experiences, the child must be involved in activities which directly relate to cognitive performance Each of these authors offers numerous suggestions to the practitioner for games and strategies that are useful with certain types of children. These theorists believe that "motor is a medium" for increasing academic performance but only to the extent that specific academic objectives are developed for the selected movement experiences.

Cratty's (1972) second category is called "Perceptual-Motor Theories" (p. 52) and includes the theories and programs of Barsh (1965), Getman (1964) and Kephart (1960). These three theorists emphasize the development of certain perceptual-motor bases which they feel underlie successful academic performance. Their tests are designed to identify the perceptual-motor bases and their programs to remediate the identified problems. The remediation of

these perceptual-motor problems will then lead to increased academic performance. In general the research fails to support these types of programs, although many of the studies have inappropriate designs which makes the interpretation of data difficult (Klesius, 1972; Seefeldt, 1974; Thomas, 1975).

The third category of the theorists mentioned by Cratty (1972) is "Neurological Organization" (p. 64) and includes the work and research by Delacato(1966). This theory suggests that unless human infants go through the normal stages of development which Delacato identifies, they will be ineffective in their use of sensory input, communications and motor activities. If Delacato's examination indicates the child has missed one of these stages, a program of remediation is begun based heavily on motor patterning (motor patterning involves manual manipulation of the appendages as well as certain other movement sequences). An extensive review of the research on this theory by Glass and Robbins (1967) suggests that there is little support for it. In fact, according to Cratty (1972, p. 69) "Seven major medical and health organizations[1] have stated that patterning was 'without merit' and chided its supporters for claiming cures without documentation."

CORRELATIONAL RESEARCH

The theories mentioned previously have basically been developed by clinical psychologists who have observed the frequency with which motor dysfunction is paired with learning difficulties. According to Seefeldt (1974) this "has led to the hypothesis that a strong relationship exists

---

1 American Academy for Cerebral Palsy, American Academy of Physical Medicine, American Congress of Rehabilitation Medicine, Canadian Association for Children with Learning Disabilities, Canadian Association for Retarded Children, Canadian Rehabilitation Council for the Disabled, National Association for Retarded Children.

between motor and cognitive function." (p. 276) Thus, many studies seek to establish the relationship between these domains and try to use tests in the motor domain as predictors of performance in the cognitive domains.

Results from these correlational studies fall into several patterns which at first appear confusing and contradictory. However, a careful organization of these studies presents fairly consistant findings. Groupings of studies should revolve around the following variables: types and quality of measurements used for assessing perceptual-motor function and the characteristics of the children used as subjects. The characteristics of children are subdivided into children with compensatory problems versus normal children and younger versus older children.

The types of variables used to assess P-M function vary across a broad spectrum. If these types were placed on a continuum, the range would include gross motor skills such as hopping or walking around obstacles and fine motor skills such as sorting and matching shapes. Seefeldt (1974) has classified these variables into four general categories that he calls symptoms of perceptual-motor dysfunction which are associated with learning disabilities. These categories include balance and postural control, temporal-spatial relationships, coordination of body parts, and body image. In general, coordination and balance items have tended to correlate more highly with academic performance than have gross motor skills (Chissom, 1971; Ismail & Gruber, 1967). However, this relationship appears to be a developmental factor. Chissom (1971) and Thomas and Chissom (1972) have reported relationships between P-M variables involving fine eye-hand coordination and academic performance measures to be highest for kindergarten children but decreasing as age increases until by grade three, relationships are no longer significant.

Several follow-up studies by Thomas and others (Chissom, Thomas & Biasiotto, 1972; Chissom, Thomas & Collins, 1974; Thomas & Chissom, 1973, 1974; Thomas, Chissom & Biasiotto, 1972) have consistantly found positive relationships between P-M items involving fine eye-hand coordination, shape recognition and matching and academic performance for normal kindergarten and first grade children. In addition, these studies have reported that P-M variables of the type described above:

(1) Are useful when combined with academic performance tests for assigning first grade children to reading groups.
(2) Can identify 65-80% of the kindergarten children classified in the bottom quartile on academic performance.
(3) Are quite useful for predicting concurrent academic performance but are not useful for predicting first grade performance from the kindergarten performance.

Gross movement variables such as hopping, running, jumping, throwing, etc. have not been useful as predictors of academic performance except under certain conditions i.e. if the task is complicated, serial in nature, or directions for its execution are relatively complex.

P-M variables which have strong scales of measurement i.e. time to completion as opposed to a rating of 1 to 4, generally offer more hope for good prediction. If the task is difficult enough to give an adequate spread in the distribution of scores and possess a strong measurement scale, relationships to other variables such as academic performance should be easily detected. Several of the P-M tests in current use offer little hope of adequate predition because of their very weak scale of measurement. In addition, good reliability (stability of performance) is difficult to obtain with young children. Potential users should be careful in selecting P-M measures for children in order to choose for proven reliability in the sample to be used.

The type child on which P-M assessments are made is vital to interpreting the results of correlational research, for instance "children with compensatory

problems" is a broadly used term and might include learning disabled children, mentally retarded children, underachievers, physically handicapped children and sometimes even socioeconomically disadvantaged children.

Several studies have compared normally functioning children with children in compensatory education programs using a variety of measures and circumstances. Lietz (1972) reported that disadvantaged subjects performed at a lower level on the Purdue Perceptual Motor Survey than advantaged children. However, within the disadvantaged group there were no sex or race differences in performance. Chisson and Thomas (1973) and Hammiel, Goodman and Wiederhold (1971) reported that P-M tests did not appear to be good predictors of academic performance for kindergarten and first grade disadvantaged subjects. Chissom and Thomas also pointed out that the prediction problems seem to lie with getting good academic performance data on young disadvantaged subjects. In a later study, Thomas and others (1974) reported that performance on both P-M and academic variables was consistantly higher for disadvantaged subjects classified as "normal" performing than for learning disabled disadvantaged children. However, the correlations between the P-M and academic measures were consistently higher for the learning disabled children, supporting the concept of the global nature of learning disabilities. These results are in agreement with a study by Greenberg and Alshan (1974) using the Bender Motor-Gestalt test. Studies using mentally retarded children as subjects have consistantly found that they perform significantly below normal children on most perceptual-motor tasks. Factor analytic studies of perceptual-motor skills for mentally retarded children have generally used similar measures to those used for normal children and have reported similar factor structures. However, there have been slight tendencies toward fewer factors

and heavier loadings on academic factors by perceptual-motor measures, again suggesting the global effects of compensatory problems (Cratty & Martin, 1970; Maloney et al., 1970; Neeman, 1971).

A summary of the section involving correlational relationships between perceptual-motor and academic measures suggests:

(1) the importance of selecting perceptual motor tests with good reliability, a strong scale of measurement, and of appropriate difficulty to give a reasonable dispersion of scores.

(2) the need for deciding the objectives of the testing i.e. if you want to measure underlying aspects of academic performance, select tests which have these components.

(3) compensatory children consistantly perform lower than "normally" performing children on perceptual-motor tests as well as on academic measures. However, if the results from learning disabled children can be generalized to other types of compensatory problems, perceptual-motor and academic performance measures are more highly related in compensatory children.

(4) certain types of perceptual-motor tests are useful for concurrent academic prediction but not useful for long term prediction of academic performance.

EXPERIMENTAL RESEARCH

Most of the theories discussed previously as well as the finding which indicated significant relationships between perceptual-motor and academic performance have led to the development of prescribed P-M programs which attempt to increase academic performance. The experimental research can be grouped by the theory subscribed to, thereby leaving many studies ungrouped

since they fail to use any of the remedial programs completely; or the research can be grouped by the type child they deal with which is the approach selected here. The type of child can encomapss normal versus compensatory as well as older versus younger. In addition, treatment programs can be grouped according to objectives, i.e. remediation of academic problems by altering perceptual-motor performance or by using movement activities with specific cognitive goals.

Several studies exist which involve perceptual-motor programs for normal kindergarten and first grade children (Falik, 1969; Lipton, 1970; McCormic & Schnobrich, 1971; McCormick et al., 1968; O'Connor, 1969; Thomas et al., 1975). These studies are generally in agreement in reporting significant changes in perceptual-motor skills but few changes in academic function. The programs have generally been criticized because of short training periods, poor measurement, inadequate controls, and lack of a long term follow-up. The study by Thomas and others (1975) does not have most of these problems as the training period is reasonably long and daily, the dependent variables are strong in terms of reliability and scale of measurement, the training program identifies specific perceptual-motor dysfunctions related to academic performance and seeks to alter these variables, and there is both an immediate and long term follow-up. Yet results from this study are basically equivocal as in previous studies lacking these controls. While this is a rather limited amount of data from which to generalize, it might be suggested that perceptual-motor training programs lack effectiveness with normal children even when the subjects are in kindergarten where the correlational data suggests that the strongest degree of relationship exist.

Results with children classed as compensatory in nature are not as clearly defined. Studies by Edgar and others (1969), McCormick and others

(1968) and Painer (1966) suggest some academic benefit for children in compensatory programs as a result of perceptual-motor training. However, Balow (1971) in summarizing 12 studies of perceptual-motor programs for children with learning disabilities failed to find evidence which supported academic benefit for these programs. Glass and Robbins (1967) reported similar findings for a variety of studies dealing with Delacato's "neurological organization" program and Robinson (1971) found similar results for the Frostig (prior to 1970), Kephart and Winter Haven programs.

In summary, a series of statements by Seefeldt (1974) seem particularly appropriate:

> Transfer from one situation to another is directly related to the extent that the elements in the two situations are identical in nature. Thus, the notion that increased proficiency in motor skills will enhance academic achievement is tenable only to the degree that (a) the motor elements of the two situations are identical, (b) the motor skills are part of a developmental sequence that is prerequisite to the academic task, or (c) the process of learning the motor skills includes the concomitant learning of other skills that enter into the academic situation. Programs that seek transfer of learning beyond the conditions just outlined are destined to fail. (p. 282).

Other important variables to consider in experiments involving perceptual-motor training include the length and intensity of the training program, the individualized nature of the program, and an "incubation" effect. Many of the experimental programs attempt to remediate deficiencies in compensatory children that have been created by several years of neglect. It is foolish to think that a three month, one-half hour per day treatment can remediate a problem that has been developing over a four or five year period. If basic skill deficiencies are to be remediated, they must be diagnosed earlier or the treatment program must be more intensive and extended for longer time periods.

Researchers must also begin to evaluate perceptual-motor programs that are individual in nature. All developmental difficulties do not require the same treatments equally spaced over the same time interval. While individualized programs create design and analysis problems for experimental research, they offer the only reasonable solution to the type difficulties discussed in this paper. In addition to individualizing a child's program of treatments, it is essential that once his difficulties are "remediated" that a periodic check be made on him to prevent regression and to cycle him back into the treatment program if regression occurs.

One additional aspect in the evaluation of perceptual-motor programs is what Maccoby and Bee (1965) call an "incubation" effect. Applied to perceptual-motor training, this term suggests that increases in perceptual-motor skills may require some period of time to translate into increased academic performance. This hypothesis was evaluated in the previously cited study by Thomas and others (1975) where a perceptual-motor training program administered in kindergarten was evaluated at the end of the treatment program and again in the first grade. Results indicated that while perceptual-motor skills trained for were significantly changed at the end of kindergarten, neither immediate nor long-term follow-up evaluations of academic performance showed significant changes.

IMPLICATION FOR THE PRACTITIONER

What implications does all the previously cited research findings and problems have for an elementary physical education teacher? I believe these findings and some common concepts about the purposes of elementary physical education clearly dictate the appropriate action patterns.

First, if we can agree that the two major functions of the elementary

physical education program are contributing to (1) the physical fitness level (defined here as cardio-respiratory endurance), strength and muscular endurance and (2) motor skill acquisition in children; then perceptual-motor programs as defined in this paper play a very small part in elementary physical education. To the extent that perceptual-motor activities are also those activities which contribute to the major objectives of elementary physical education, they should be included in the program. However, our main concern with these activities should be placed on the quality of the movement pattern, not the use of the movement pattern to play a learning game. This suggestion is based on the previously established notion that for gross motor skills to affect academic performance, the skill must be used to attain an academic performance objective i.e. running around a letter outlined on the ground. To justify inclusion in an elementary physical education program, a teacher must emphasize the contribution the running makes to cardiovascular development and development of correct running patterns as well as the academic objective of correctly outlining the letter. Most programs using these types of motor performance activities that I have observed emphasize the academic objective with little or no concern for the motor pattern. In certain circumstances the above process may not be bad, but it certainly has limited value as an objective for elementary physical education. In summary, perceptual-motor activities clearly directed toward classroom performance objectives probably have limited value in the elementary physical education program.

The preceeding statements do not necessarily imply that the elementary physical educator has no function relative to perceptual-motor programs; just that currently used perceptual-motor programs have limited value as a replacement

for elementary physical education. The elementary physical educator may be the most logical choice in the elementary school to implement and evaluate a perceptual-motor program apart from physical education.

Based on previously presented concepts, the elementary physical educator should recommend that perceptual-motor programs observe several stipulations. First, children should be selected for the training program for whom some benefit is possible. At best, programs have values for only young (preschool and first grade) normal children with the benefits being minimal for them. Almost certainly, perceptual-motor programs offer little benefit in academic performance for normal children after grade one. Compensatory children seem most likely to benefit from perceptual-motor training with underachievers, disadvantaged, learning disabled and mentally retarded showing most to least benefit.

A second factor of importance is the qualities of the specific perceptual-motor program. Only programs which seek to remediate perceptual-motor dysfunctions underlying academic dysfunctions and programs that use movement to meet specific academic objectives offer hope for success, with the latter probably being prefered. Practitioners must also remember that the length and intensity of the program are important factors. Easy and instant panaceas do not exist. If a decision is made to use perceptual-motor training, a long term and intense program will be necessary in order to significantly alter academic performance. In addition, the program must be individualized to each child with provisions for periodic checking on remediated problems. This type of program requires a large committment of money, time and personnel from the elementary school and this fact should be clearly recognized by all involved. It is important that long term follow-ups be

made after termination of the program so some time is allowed for the possible "incubation" effect previously discussed.

Some perceptual-motor tests also offer useful screening devices for school readiness and are good predictors of concurrent performance. However, the usefulness in predicting first grade success from kindergarten performance is no greater than other readiness measures used for this purpose.

A final point involves other effects of perceptual-motor training. Cratty (1972) points out that since several of the programs do contribute to the development of motor skills, children have benefited in this manner even though increased academic performance may have been the objective of the program. Other factors recently alluded to by several authors (Fleming, 1972; Seefeldt, 1974; Thomas, 1973, 1975) include self-concept and attention span. If perceptual-motor training positively influences self-concept because of the success oriented nature of many of the programs, this may result in increased academic performance. However, this presupposes that self-concept is not situation specific and that it positively influences classroom performance. Data to evaluate this supposition are not available at this time. The other variable alluded to is attention span. If a child can attend to movement activities for a longer period of time, then this increased attention span may transfer to classroom learning. However, both these variables are probably related to a basic principle earlier attributed to Seefeldt (1974), that for transfer to occur the elements of the two situations must be extremely similar. Thus neither self-concept or attention span may be transferable variables from perceptual-motor to academic situations.

As a summary statement, I would again like to emphasize that perceptual-motor programs planned to meet specific academic objectives are probably

useful for certain children provided these programs begin early and are individual and intensive in nature. However, perceptual-motor activities have limited value as a replacement for part of the regular elementary physical education program unless these activities are structured to meet the two major objectives (physical fitness and skill development) of that program.

References

Barlow, B. Perceptual-motor activities in the treatment of severe reading disabilities. The Reading Teacher, 1971, 24, 513-525

Barsch, R. H. Achieving Perceptual-Motor Efficiency, A Space-Oriented Approach to Learning. Special Child Publications: Seattle, 1965.

Chissom, B.S. A factor analytic study of the relationship of motor factors to academic criteria for first-and third-grade boys. Child Development, 1971, 42, 1133-1143.

Chissom, B. S. & Thomas, J. K. Relationship between perceptual-motor and academic measures for disadvantaged pre-school children. Perceptual and Motor Skills, 1973, 36, 152-154.

Chissom, B. S., Thomas, J.R. & Biasiotto, J. Canonical validity of perceptual-motor skills for predicting an academic criterion. Educational and Psychological Measurement, 1972, 32, 1095-1098.

Chissom, B.S., Thomas, J. R. & Collins, D.G. Relationships among perceptual-motor measures and their correlations with academic readiness for preschool children. Perceptual and Motor Skills, 1974, 39, 467-473.

Cratty, B. J. Physical Expressions of Intelligence. Prentice Hall: Englewood Cliffs, N.J., 1972.

Cratty, B. J. & Martin, M. M. Perceptual-Motor Efficiency in Children. Lea and Febiger: Philadelphia, 1969.

Cratty, B. J. & Martin, M. M. The effects of a program of learning games upon selected academic abilities in children with learning difficulties. Los Angeles, 1970.

Delacato, C. H. Neurological Organization and Reading. Charles C. Thomas, Publishers: Springfield, Ill., 1966.

Edgar, C. Ball, T. McIntyre, R. & Shotwell, A. Effects of sensory-motor training on adaption behavior. American Journal of Mental Deficiency, 1969, 73, 713-720.

Falik, S. The effect of special perceptual-motor training in kindergarten on reading readiness and on second grade reading performance. Journal of Learning Disabilities, 1969, 2, 10-17.

Fleming, J. W. Perceptual-Motor programs. In R. N. Singer's (ed) The Psychomotor Domain. Lea and Febiger: Philadelphia, 1972

Frostig, M. Movement Education: Theory and Practice. Follet Ed. Co.: Chicago, 1970.

Frostig, M. & Harne, D. The Frostig Program for the Development of Visual Perception. Follett Publishing Co.: Chicago, 1964

Gelman, G. N. & Kane, E. R. The Physiology of Readiness, An Action Program for the Development of Perception for Children. P.A.S.S., Inc.: Minneapolis, 1964.

Glass, G. & Robbins, M. P. A critique of experiments on the role of neurological organigation in reading performance. Reading Research Quarterly, 1967, 3, 5-51.

Hamill, D. & Goodman, L. & Wiederhalt, J.L. Use of the Frostig DTVP with economically disadvantaged children. Journal of School Psychology, 1972, 9, 430-435.

Humphrey, J. H. & Sullivan, D. D. Teaching Slow Learners Through Active Games. Charles C. Thomas, Publisher: Springfield, Ill., 1970.

Ismail, A.H. & Gruber, J. J. Integrated Development: Motor Aptitude and Intellectual Performance. Charles E. Merrill: Columbus, Ohio, 1967.

Kephart, N. C. The Slow Learner in the Classroom. Charles E. Merrill Co: Columbus, Ohio, 1960.

Kiphard, E. J. & Huppertz, H. Erziehung durch Bewegung. Durr. Bed Godesberg (Germany), 1968.

Klesius, S. E. Research findings regarding perceptual-motor development and academic performance. Proceedings: Region East Perceptual-Motor Conference, Clearwater, Fla., 1972.

Leitz, E. S. Perceptual-Motor abilities of disadvantaged and advantaged kindergarten children. Perceptual and Motor Skills, 1972, 35, 887-890.

Lipton, E. D. A perceptual-motor development program's effect on visual perception and reading readiness of first grade children. Research Quarterly, 1970, 41, 402-405.

MacCoby, E. & Bee, H. Some speculations concerning the lag between perceiving and performing, Child Development, 1965, 36-367-377

McCormick, C. C., Schnobrich, J.N., Footlik, S. W. & Poetker, B. Improvement in reading achievement through perceptual-motor training. Research Quarterly, 1968, 39, 627-633.

McCormick, C. C. & Schnabrich, J. N. Perceptual-motor training and improvement in concentration in a Montessori school. Perceptual and Motor Skills, 1974, 32, 71-77.

Maloney, M. P., Ball, T. S. & Edgar, C.L. Analysis of the generalizability of sensory-motor training. American Journal of Mental Deficiency, 1970, 74, 458-469.

Mosston, M. Teaching Physical Education. Charles E. Merrill Co.: Columbus, Ohio, 1966.

Neeman, R. L. Perceptual-motor attributes of mental retardates: a factor analytic study. Perceptual and Motor Skills, 1971, 33, 927-934.

O'Connor, C. Effects of selected physical activity upon motor performance and academic achievement of first graders. Perceptual and Motor Skills, 1969, 29, 703-709.

Painter, G. The effect of a rhythmic and sensory motor activity program on perceptual motor spatial abilities of kindergarten children. Exceptional Children, 1966, 32, 113-116.

Robinson, H. M. Perceptual-motor training--does it result in reading improvement-- background of information and research. Paper presented at the 17th Annual Convention of the International Reading Association, Atlantic City, N.J., 1971.

Seefeldt, V. Perceptual-motor programs. (In Exercise and Sport Sciences Reviews (Vol 2). Academic Press: New York, 1974).

Thomas, J. R. Perceptual-Motor Development. (In T. Cureton's Encylopidia of Physical Education, in press, 1976).

Thomas, J. R. & Chissom, B. S. An investigation of the combination of a perceptual-motor test and a cognitive ability test for the purpose of classifying first-grade children into reading groups. Psychology in The Schools, 1973, 10, 185-189.

Thomas, J. R. & Chissom, B. S. Prediction of first grade academic performance from kindergarten perceptual-motor data. Research Quarterly, 1974, 45, 148-153.

Thomas, J. R. & Chissom, B.S. Relationships as assessed by canonical correlation between perceptual-motor and intellectual abilites for pre-school and early elementary age children. Journal of Motor Behavior, 1972, 4, 23-29.

Thomas, J. R., Chissom, B. S. & Biasiotto, J. Investigation of the Shape-O Ball Test as a perceptual-motor task for pre-schoolers. Perceptual and Motor Skills, 1972, 35, 447-450.

Thomas, J. R., Chisson, B. S. & Booker, L. Perceptual-motor and academic relationships for disadvantaged children classified as learning disabled and normal. American Corrective Therapy Journal, 1974, 28, 95-99.

Thomas, J. R., Chissom, B. S., Stewart, C. & Shelley, F. Effects of perceptual-motor training on preschool children: A multivariate approach. Research Quarterly, 1975, 46, 505- 513.